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Notice of Allowability	Application No.	Applicant(s)	
	10/717,604	HAO ET AL.	
	Examiner	Art Unit	
	Richard L. Leung	3744	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendment filed 12 September 2005.
2. ☒ The allowed claim(s) is/are 1-4,6-9,12-17 and 20.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☒ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☒ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|---|--|
| 1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____. |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date _____ | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____. |

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

The application has been amended as follows:

Claims 6-9 have been renumbered 5-8, respectively.

Claim 12 has been renumbered 9.

Claims 13 and 14 have been renumbered 14 and 15, respectively.

Claims 15-17 have been renumbered 10-12, respectively.

Claim 20 has been renumbered 13.

2. The examiner has approved the following changes to the drawings: Fig. 4 is too dark to reproduce clearly. A replacement figure, preferably without shading, must be submitted. In order to avoid abandonment of the application, applicants must make these above agreed upon drawing changes.

3. The following is an examiner's statement of reasons for allowance: A search of the prior art has failed to demonstrate a clear teaching of Applicants' claimed invention. While miniature thermoacoustic devices comprising a resonant tube and stack for transporting thermal energy are already known in the art, e.g. US 5165243 (Bennett), the specific use of a vertical comb-drive as an acoustic driver for a micro-scale

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thermoacoustic device has not been previously disclosed. As best understood, vertical comb-drives have typically been applied to micro-optical systems and used, for example, as actuators to displace or deform mirrors. See US 6384952 B1 (Clark et al.). These optical devices are considered substantially different from the claimed thermoacoustic system, and a search of the prior art has not revealed a clear suggestion to use a vertical comb-drive as an acoustic driver for such a system. Likewise, the claimed method of using gray scale etching to construct the resonance tube used in thermoacoustic systems also appears absent from the prior art. While gray scale etching is a known process for fabricating micro-devices such as miniature lenses and other micro-optical apparatuses, as taught for example by US 5480764 (Gal et al.), there is no distinct demonstration or suggestion in the prior art of specifically using gray scale etching to create resonance tubes for thermoacoustic systems. Accordingly, Applicants' claims are considered allowable.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

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4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 4722201 (Hofler et al.): discloses a thermoacoustic device comprising a resonant tube having a tapered portion.

US 4858441 (Wheatley et al.): discloses an acoustic cooling engine having a resonant tube with a taper.

US 5319938 (Lucas): discloses an apparatus comprising a tapered acoustic resonator chamber.

US 5480764 (Gal et al.): discloses the use of grayscale technology in fabricating devices.

US 6384952 B1 (Clark et al.): discloses an apparatus comprising a vertical comb drive.

Hao, Zhili et al. "A Miniature Thermoacoustic Cryo-cooler Driven by a Vertical Comb-Drive." *Proceedings of SPIE*, Vol. 4983 (2003), pp. 139-148.

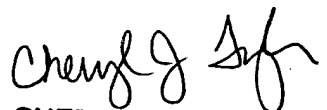
5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard L. Leung whose telephone number is 571-272-4811. The examiner can normally be reached on Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cheryl J. Tyler can be reached on 571-272-4834. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Richard L. Leung
Examiner
Art Unit 3744


CHERYL TYLER
SUPERVISORY PATENT EXAMINER

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